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Evaluation of Anti-diabetic Activity of Isolated Fractions of Aegle Marmelos

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Abstract

The aim of this study was to evaluate the anti-diabetic activity of isolated fractions from *Aegle marmelos.* To achieve this, experiments were conducted on rats with induced diabetes using STZ. The isolated fractions were administered to the rats at different doses, specifically 20 mg/kg and 40 mg/kg, over duration of 28 days.

Using the accu-chek active test meter, blood glucose levels were measured to assess the anti-diabetic effects of the isolated fractions. Additionally, a comparison was made with the standard anti-diabetic medication, pioglitazone, which was given to another group of rats at a normal dose of 2.7 mg/kg.

The results of this study indicated that the isolated fractions of Aegle marmelos exhibited considerable anti-diabetic activity. Furthermore, the study also included acute and sub-acute toxicology assessments to determine the safety of the isolated fractions at higher doses. The acute toxic study demonstrated that Aegle marmelos was photochemically safe up to 300 mg/kg, while the sub-acute toxic study showed safety up to 1000 mg/kg.

Overall, these findings suggest that the isolated fractions of Aegle marmelos have promising anti- diabetic potential, making them worthy candidates for further investigation and potential therapeutic applications.

1. INTRODUCTION

Diabetes mellitus is a complex metabolic condition characterized by chronic hyperglycemia and impaired insulin secretion, disrupting carbohydrate, fat, and protein metabolism, as well as insulin action. While type II diabetes primarily affects middle-aged individuals, it's concerning that 55% of diabetes-related deaths occur in women [1]. The global prevalence of diabetes was estimated to be 2.8% in 2000 and is projected to increase to 4.4% by 2030[2]. Current therapies for diabetes can have side effects, prompting the search for effective, safe, and affordable alternatives, such as medicinal plants, which have been used since ancient times for disease prevention and treatment, including diabetes [3]. Advancements in molecular biology and information technology have deepened our understanding of the mechanisms of action of herbal drugs and phytomedicines, which differ in various aspects from synthetic drugs or single chemical entities [4].

Among the medicinal plants, *Aegle marmelos*, commonly known as Bael, thrives in subtropical regions up to an altitude of 1200 m above sea level, particularly in dry forests of hilly and plain areas. This plant

boasts numerous pharmacological activities, including antibacterial, anti-inflammatory, antifungal, antihelminthic, antiprotozoal, antispermatogenic, antidiabetic, laxative, febrifuge, and expectorant properties. Unfortunately, it has been declared vulnerable and is listed in the red list [5].

Aegle marmelos is the sole member of the Aegle genus and can either be a deciduous shrub or a medium-sized tree, reaching heights of up to 13 m. The plant's distinctive features include pale brown or grayish bark with fine fissures and long straight spines, typically occurring in pairs or singly. When cut, the plant releases slimy sap. The leaves are alternate and ovate with pointed tips and circular bases, either untoothed or with shallow rounded teeth. The flowers are pale green or yellowish, forming drooping unbranched bundles at the top of twigs and leaf axils. The leaves are particularly rich in bioactive compounds synthesized as secondary metabolites, making them crucial accumulators within the plant [6].

In light of the plant's diverse medicinal properties, this study aimed to investigate the phytochemical and antibacterial activity of A. marmelos leaves. Additionally, the study explores the potential anti-diabetic properties of this remarkable plant.

2. MATERIAL AND METHODS

2.1 Collection of Plant Material

The ripe fruits of A. marmelos were collected from the local area of Peddapalli in the month of May-June. It was identified and authenticated. The specimen voucher was stored in the department’s herbarium. The fruits were washed under tap water and the pulp was separated and shade dried. The pulp is dried and then powdered by using an electrical mixer, creating coarse powder that was stored in polythene bags for further use. The preliminary pharmacognostic characteristics of the powder, such as ash value, loss on drying and extractive values were determined by using suitable methods [7].

2.2 Extraction and Isolation [8]

500 g of dried pulp of A. marmelos was extracted by using 1000 ml of each water and methanol with 6–8 cycles of Soxhlet extractor separately and filtered. The filtrate was evaporated under vacuum in rotary evaporator. Phytochemical screening was carried out to detect the presence of bioactive components by standard procedures. The tests were detected by visual observation of color change or by precipitate formation, after the addition of specific reagents to the test solution. Thin layer chromatography of methanolic extract was performed on the pre-coated and previously activated aluminum plates.

Methanolic extract gives spot in TLC [acetone: chloroform: benzene (4:4:1V/V/V)] and the individual components were isolated by preparative TLC and HPLC.

2.3 Isolation and Purification [8]

The methanolic extract of A. marmelos was subjected to IR spectroscopy and further to HPLC study. Figure 1: The IR spectral study showed the presence of functional groups of phytoconstituents such as marmelosin, marmelid and psoralen. It indicates the presence of functional group i.e. aromatic ring, esters and carboxylic acids, which are present in the structures of marmelosin and psoralen. HPLC study of methanolic extract confirms the functional group i.e. aromatic ring, esters and carboxylic acids which were present in the structures of marmelosin and psoralen. The further, HPLC study of methanolic extract clarifies the presence of umbelliferone, scopoletin and marmelosin respectively when compared with the standard mixture and had Rf values at 0.52 and 0.56 and 0.58. Figure 2: represents the chromatogram of methanolic extract. The first peak in chromatogram indicates the presence of scopoletin and the second peak for the umbelliferone. Figure 3: TLC of Aegle Marmelos Sample indicates the test sample of Aegle marmelos run through mobile phases and indicated Rf 0.21 and 0.22 when compared with the standard samples.

2.4 ANIMAL STUDIES

Swiss Albino male mice weighing 25–30 g for acute and subchronic toxicity studies and adult Wistar rats of either sex weighing 180–220 g were used for antidiabetic study. The inbred animals were procured from the animal house of Mahaveer Enterprises, Hyderabad. They were housed five per cage under standard lab conditions with a room temperature at 22 ± 2 0C with 12 hr light/dark cycle. The animals were adjusted to lab conditions one week and given standard pellets chow and water ad

libitum. Ethical committee clearance was obtained from IAEC of Trinity College of Pharmaceutical sciences, Peddapalli, IAEC/008/07/2021 CPCSEA.

2.6 Toxicity Study [9]

The procedure was followed as per OECD guidelines (Organization of Economic Cooperation and Development) 423 (Acute oral toxicity - Acute toxic class method). Three male albino mice weighing between 20–25 gm were taken into the study. 300 mg/kg body weight p. o. is taken as the starting dose level of the isolated fractions. Dose was administered accordingly to the overnight fasted mice with water ad libitum, food was not given till 3–4 hours post drug administration and seen for the evidence of toxicity. Body weights of the mice were taken at the start and end of the treatment, monitored for any alterations in eyes, skin, fur and mucous membranes and any systems like circulatory, respiratory, central, autonomic nervous systems, behavior pattern and locomotor activity and signs like convulsions, tremors, salivation, lethargy, diarrhea, sleep and coma were took a note. Both the onset and signs of toxicities if any were observed for 14 days and tabulated in table 2.

2.7 Oral Glucose Tolerance Test (OGTT)

OGTT was done in both the pre-treated and post-treated groups on the 7th and 12th week after the streptozotocin treatment. An extra four groups of normal rats with similar age were used to study the effects of these treatments on OGTT in normal rats. The effect of the fractions on glucose overloaded hyperglycemia was learned in all the groups. Normal rats kept under fasting overnight nearly 12h, were taken into 6 groups (n = 6) of which group I being a control, group II, III, IV, V and VI were given *Aegle marmelos* 20, 40 mg/kg p. o. respectively, group VII rats were given 2.7 mg/kg of pioglitazone intragastrically. Group III to VII are pre-treated set whereas post-treated set remains untreated. Zero-hour sample was measured for blood glucose levels by tail vein puncture. Animals were given oral glucose (4g/kg BW) after half an hour past drug administration and the blood glucose levels were measured at 0.5, 1, 2, and 3 h past glucose administration [11]. Blood glucose levels were read through a glucometer (Accu-chek ActiveTM Test meter). Results were tabulated in Table 4–6.

2.8 Statistical analysis

All the values were expressed as mean ± standard error (SEM). One way analysis of variance followed by Dunnet's test comparing with p less than 0.05 were noted significant among the groups.

3. Results

3.1 Isolated Fractions

The *Aegle marmelos* sample solvent separation using methanol, chloroform and n-butanol serially, the bioactive fraction is subjected to column separation and partitioned with mixture of two solvents with near polarity at various ratios as depicted in the scheme below, the fraction with good biological activity is subjected to flash chromatography and the resulting bioactive fractions are isolated using preparative TLC,with 20 X 20 cm glass plates (0.5 mm) which are silica gel G coated. (Figure.3)The test sample of *Aegle marmelos* run through mobile phases and indicated Rf 0.21 and 0.22 when compare with the standard samples. These sample indicates that the confirmation of constituents in tested for *Aegle marmelos.*

3.2 Acute oral toxicity study

The acute oral toxicity study was conducted in accordance with the OECD guidelines 423 (Acute toxic class procedure). A beginning dose of 300 mg/kg *Aegle marmelos* fractions were given to three male mice and monitored for three days. No significant change is there in body weight in group with and without taking treatment and no toxicity signals were seen even with the repeated experiments at same dosing level, the mice were monitored for 14 days, Table 2 indicates that no alterations were there in the first experimental set. LD50 cut off mg/kg B.W was seen as above 300mg/kg bw and globally harmonized system (GHS) classes also come in category 4, as the dose studies are limited to 300 mg/kg bw.

3.3 Effect of Glucose Administration

Table 3 represents the Effect of blood glucose levels after oral glucose tolerance test in normal rats treated with drugs, glucose administration had shown a marked enhancement in the blood glucose levels of control rats from 0.5 hr and remained significant for 1st and 2nd hours respectively.

3.4 Effect of OGTT on 7th week pretreated rats

In the effect on OGTT on 7th week in rats treated with drugs, a marked increase $p < 0.05$ was seen in the blood glucose concentrations of control at 0 hour compared to other groups. Experimental values were clearly.Aegle marmelos 20 mg/kg showed a marked reduction in the blood glucose levels at 1, 2 and 3 hours after glucose over load at $p < 0.05$, $p < 0.05$ and $p < 0.01$ respectively, compared to negative control, Aegle marmelos 40 mg/kg exhibited a marked reduction $p < 0.05$ in the blood glucose levels at all the time points after glucose overload. Results were tabulated in Table 4.

3.5 Effect of OGTT on 7th week in post treated rats

Table 5 shows the effect on OGTT on 7th week in rats which did not receive prior treatment (post treated rats), a marked increase $p < 0.001$ in blood glucose was observed in all the groups compared to control rats at 0 hour, treatment with *Aegle marmelos*20 mg/kg.

3.6 Effect of OGTT on 12th week in post treated rats

Table 6 shows the effect on OGTT on 12th week in rats which did not receive prior treatment (post treated rats), a marked increase $p < 0.001$ in blood glucose was observed in all the groups compared to control

rats at 0 hour, treatment with *Aegle marmelos* 20 and 40 mg/kg didn't show any marked changes in the blood glucose concentrations compared to negative control, a marked rise $p < 0.05$ in the blood glucose concentrations were observed 30 minutes after glucose overload with *Aegle marmelos* 20 mg/kg and a significant increase was observed after 30 minutes and 1 hour of glucose overload in *Aegle marmelos* 40 mg/kg treated rats.

4. DISCUSSION

In this study, the Acute and sub-acute toxicities of the fractions were tested and LD50 cut off mg/kg B.W was seen as above 300mg/kg b.w. and globally harmonized system (GHS) classes also come in category 4, as the dose studies are limited to 300 mg/kg b.w. Drug treated mice do not exhibit any hematological alterations compared to normal control animals.

Pretreatment with Aegle marmelos 20 mg/kg shows a marked decrease in blood glucose concentrations on the first ($p < 0.05$), 7th ($p < 0.01$), 14th ($p < 0.001$), and 21st day ($p < 0.001$) compared to the blood glucose concentrations of the negative control group, while the decrease in blood glucose concentrations was prominent on the 14th ($p < 0.05$) and 21st ($p < 0.01$) days only, compared to blood glucose concentrations of day one. *Aegle marmelos* 40 mg/kg exhibited a marked decrease in blood glucose concentrations on the 1st ($p < 0.01$), 7th ($p < 0.001$), 14th ($p < 0.001$), and 21st days ($p < 0.001$) compared to the blood glucose concentrations of the negative control group, while the decrease in blood glucose concentrations was prominent on the 14th ($p < 0.05$) and 21st ($p < 0.01$) days only, compared to blood glucose concentrations of day one.

Post-treated *Aegle marmelos* 20 mg/kg did not exhibit a marked decrease in the blood glucose concentrations on 14th and 21st days ($p < 0.05$) and $p < 0.001$, respectively, compared to the negative control group and 14th ($p < 0.05$) and 21st ($p < 0.001$), respectively, compared to basal blood glucose concentrations on day one, and treatment with Aegle marmelos 40 mg/kg did not show a marked reduction on the 7th ($p < 0.05$), 14th ($p < 0.01$), and 21st day ($p < 0.001$), compared to the negative control group and 7th ($p < 0.05$), 14th ($p < 0.01$), and 21st days ($p < 0.001$), compared to basal blood glucose concentrations on day one. The results are comparable with that of standard-treated groups.

In the post-treatment rats, the basal blood glucose amounts were more than those seen in rats which take isolated fractions and pioglitazone from the 4th week, whose protective action on pre-treated was described through the certainty that there causes the pancreatic β-cells disruption, there will be insulin sensitivity, evidencing the less basal blood glucose amounts in them. In conclusion, utilizing these drugs as prophylactic in basal hyperglycemic stage persons could decrease the risk of progressing into T2DM

and also have therapeutic importance in the treating T2DM.

5. CONCLUSION

Acute and sub-acute toxicities of the fractions were tested and LD50 cut off mg/kg B.W was seen as above 300mg/kg b.w. and globally harmonized system (GHS) classes also come in category 4, as the dose studies are limited to 300 mg/kg b.w. Drug treated mice do not exhibit any hematological alterations compared to normal control animals. Histopathological examination of internal organs did not exhibit changes in their normal architecture suggesting no damage caused by both the fractions. The results indicate the potential use of Aegle marmelos in managing diabetes mellitus. The phytochemical screening showed the presence of various bioactive compounds, indicating the plant's therapeutic potential. Further studies are necessary to understand the exact mechanisms of action and potential drug interactions. Nonetheless, the findings present a promising outlook for utilizing Aegle marmelos as an alternative treatment for diabetes.

Declarations

The authors declare no competing interests

References

1. Galicia-Garcia, Unai et al. “Pathophysiology of Type 2 Diabetes Mellitus.” *International journal of molecular sciences* vol. 21,17 6275. 30 Aug. 2020, doi:10.3390/ijms21176275.
2. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care. 2004;27(5):1047-53. doi: 221 10.2337/diacare.27.5.1047. PMID: 15111519.
3. Kooti, Wesam et al. “The role of medicinal plants in the treatment of diabetes: a systematic 223 review.” *Electronic physician* vol. 8,1 1832-42. 15 Jan. 2016, doi:10.19082/1832.
4. Wang, Ming-Wei et al. “Biological screening of natural products and drug innovation in China.” Philosophical transactions of the Royal Society of London. Series B, *Biological sciences* vol. 226 362,1482 (2007): 1093–105. doi:10.1098/rstb.2007.2036.
5. Asmita Khanal, Stefano Dall'acqua, Rameshwar Adhikari, "Bael (*Aegle marmelos*), an Underutilized Fruit with Enormous Potential to Be Developed as a Functional Food Product: A Review", *Journal of*

Food Processing and Preservation, vol. 2023, Article ID 8863630, 11 pages, 230 2023. https://doi.org/10.1155/2023/8863630.

6. Chamila Kumari Pathirana, Terrence Madhujith, Janakie Eeswara, "Bael (*Aegle marmelos* L. Corrêa), a Medicinal Tree with Immense Economic Potentials", *Advances in Agriculture*, vol. 233 2020, Article ID 8814018, 13 pages, 2020. https://doi.org/10.1155/2020/8814018.
7. Monika, S et al. “Phytochemical and biological review of *Aegle marmelos* Linn.” *Future science OA* vol. 9,3 FSO849. 23 Mar. 2023, doi:10.2144/fsoa-2022-0068.
8. Yue, Xuan et al. “Extraction, purification, structural features and biological activities of longan fruit pulp (Longyan) polysaccharides: A review.” *Frontiers in nutrition* vol. 9 914679. 25 Jul. 2022, 238 doi:10.3389/fnut.2022.914679.
9. OECD (2002), *Test No. 423: Acute Oral toxicity - Acute Toxic Class Method*, OECD Guidelines for the Testing of Chemicals, Section 4, OECD Publishing, Paris, 241 https://doi.org/10.1787/9789264071001-en.
10. Eyth E, Basit H, Swift CJ. Glucose Tolerance Test. [Updated 2023 Apr 23]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK532915/
11. Jarald, E Edwin et al. “Antidiabetic activity of flower buds of Michelia champaca Linn.” Indian journal of pharmacology vol. 40,6 (2008): 256–60. doi:10.4103/0253-7613.45151

Tables

Table 1: Phytochemical screening of *Aegle marmelos*

Sr.No.	Phytochemicalconstituents	Test	Methanolextract	Waterextract
1	Alkaloids	Maverstest	+	+
		Dragendroffstest	+	+
		Wagnerstest	+	+
		Hagerstest	+	+
2	Glycosides	Borntraoerstest	+	+
		Legalstest	+	+
3	PhenolicsandTannins	Ferricchloridetest	+	+
		Gelatinetest	+	+
		Leadacetatetest	+	+
4	Flavonoids	Shinodatest	++	+
5	Proteins	NinhydrinandMillonstest	+	+
6	Coumarin	Sodiumhydroxidetest	++	++
7	Saponins	Frothtest	+	+

+=*Presence;++=More abunclantly present*

Table 2: Acute oral toxicity studies

S.No	Drug treatment	Dose	Weight of animal Group		Signs of toxicity	Onset of toxicity	Reversible or irreversible	Duration in days
			Before treatment (1^{st} day)	After treatment (14^{th} day)				
1.	*Aegle marmelos*	300 mg/kg	20	24	No	-	-	14
2.	*Aegle marmelos*	300 mg/kg	25	31	No	-	-	14
3.	*Aegle marmelos*	300 mg/kg	20	23	No	-	-	14

A beginning dose of 300 mg/kg *Aegle marmelos* fractions were given to three male mice and monitored for three days. No significant change is there in body weight in group with and without taking treatment and no toxicity signals were seen even with the repeated experiments at same dosing level, the mice were monitored for 14 days,

Table 3 : Effect of isolated fractions on glucose overloaded hyperglycemia in normal rats

Treatment	Blood glucose levels (mg/dL) at various intervals (days)				
	0	0.5	1	2	3
Control	78 ± 2.3	147.1 ± 5.6 $^{b\#}$	163.2± 5.1 $^{b\#}$	134.2 ± 5.5 $^{b\#}$	88.4 ± 3.5^{bns}
Aegle marmelos 20 mg/kg	72 ± 3.1^{ans}	135.2 ± 4.8$^{ans\ b\#}$	143.5 ± 5.1$^{ans\ b\#}$	121.8 ± 5.1$^{ans\ b**}$	82.4 ± 1.4^{ansbns}
Aegle marmelos 40 mg/kg	65 ± 3.1^{ans}	123.3 ± 3.2$^{ans\ b\#}$	129.1 ± 3.2 $^{a*\ b**}$	102.3 ± 2.4 $^{a**\ b*}$	74.1 ± 1.1^{ansbns}
Glibenclamide (1 mg/kg p.o.).	67 ± 1.6^{ans}	135.2 ± 4.1$^{ans\ b\#}$	114.1 ± 4.2 $^{a**\ b**}$	94.1 ± 2.5 ^{a**} bns	74.3 ± 3.2^{ansbns}

Data represents mean±SEM of blood glucose levels. a = represents comparison of blood glucose levels of all the groups (n=6) with that of control, b = blood glucose levels at various time intervals compared with 0 hr blood glucose levels using one way ANOVA followed by Dunnett's test. *p<0.05; **p<0.01; #p<0.001, ns-non significant.

Table 4: Effect of isolated fractions on OGTT on 7th week in pretreated rats

Treatment	Blood glucose levels (mg/dL) at various intervals (days)				
	0	0.5	1	2	3
Control	73 ± 5 ^{a*}	158 ± 13.2^{ans} $^{b\#}$	141 ± 8.1^{ans} ^{b*}	120 ± 5.7 ^{a*} ^{b*}	95 ± 4.1 ^{a**} ^{b*}
Negative control	115 ± 11.2	183 ± 14.1	171 ± 6.2	163 ± 12.1	145 ± 8.2
Aegle marmelos 20 mg/kg	96 ± 4.1^{ans}	136 ± 3.5^{ans} ^{b*}	121 ± 4.1 ^{a*} ^{b*}	103 ± 3.5 ^{a*} bns	96 ± 8.2 ^{a**} bns
Aegle marmelos 40 mg/kg	110 ± 3.1^{ans}	130 ± 9.2 ^{a*} bns	115 ± 8.6 ^{a*} bns	108 ± 5.4 ^{a*} bns	103 ± 9.2 ^{a*} bns
PIO 2.7mg/kg	96 ± 5.4^{ans}	138 ± 6.3^{ans} ^{b*}	114 ± 5.6 ^{a**} ^{b*}	95 ± 3.4 $^{a\#}$ bns	80 ± 2.7 ^{a**} bns

Data represents mean±SEM of blood glucose levels. a = represents comparison of blood glucose levels of all the groups (n=6) with that of negative control, b = blood glucose levels at various time intervals compared with 0 hr blood glucose levels using one way ANOVA followed by Dunnett's test. *p<0.05; **p<0.01; #p<0.001, ns-non significant.

Table 5. Effect of isolated fractions on OGTT on 7th week in post treated rats.

Treatment	Blood glucose levels (mg/dL) at various intervals (days)				
	0	0.5	1	2	3
Control	67 ± 1.6 a#	153 ± 6.2 ans b#	135 ± 2.1 a* b#	105 ± 2.4 a** b*	93 ± 1.4 a** bns
Negative control	120 ± 4.1	185 ± 8.3	172 ± 4.2	158 ± 4.1	136 ± 3.1
*Aegle marmelos*20 mg/kg	111 ± 3.6 ans	163 ± 3.1 ans b*	143 ± 6.2 ansbns	133 ± 3.2 ansbns	115 ± 4.1 ansbns
Aegle marmelos 40 mg/kg	118 ± 5.2 ans	156 ± 3.5 ans b*	132 ± 4.4 a* bns	123 ± 4.2 a* bns	115 ± 3.4 a* bns
PIO 2.7mg/kg	121 ± 2.4 ans	156 ± 2.7 ansbns	125 ± 3.5 a* bns	129 ± 2.2 ansbns	112 ± 3.5 ansbns

Data represents mean±SEM of blood glucose levels. a = represents comparison of blood glucose levels of all the groups (n=6) with that of negative control, b = blood glucose levels at various time intervals compared with 0 hr blood glucose levels using one way ANOVA followed by Dunnett's test. *p<0.05; **p<0.01; #p<0.001, ns-non significant.

Table 6: Effect of isolated fractions on OGTT on 12th week in post treated rats.

Treatment	Blood glucose levels (mg/dL) at various intervals (days)				
	0	0.5	1	2	3
Control	72 ± 2.3 a#	164 ± 3.2 ansb#	132 ± 4.4 a**b**	105 ± 2.4 a#b*	83 ± 3.4 a#bns
Negative control	194 ± 9.3	266 ± 12.3 b**	252 ± 11.5 b*	234 ± 10.4 b*	223 ± 15.6 b*
*Aegle marmelos*20 mg/kg	201 ± 10.2 ans	273 ± 13.1 ans b*	251 ± 9.2 ansbns	221 ± 6.2 ansbns	216 ± 12.4 ansbns
Aegle marmelos 40 mg/kg	188 ± 8.2 ans	262 ± 11.2 ans b*	246 ± 10.2 ansb*	232 ± 11.4 ansbns	231 ± 13.3 ansbns
PIO 2.7mg/kg	202 ± 9.1 ans	282 ± 11.6 ans b**	263 ± 8.1 ansb*	248 ± 13.4 ansbns	240 ± 11.3 ansbns

Data represents mean±SEM of blood glucose levels. a = represents comparison of blood glucose levels of all the groups (n=6) with that of negative control, b = blood glucose levels at various time intervals compared with 0 hr blood glucose levels using one way ANOVA followed by Dunnett's test. *p<0.05; **p<0.01; #p<0.001, ns-non significant.

Figures

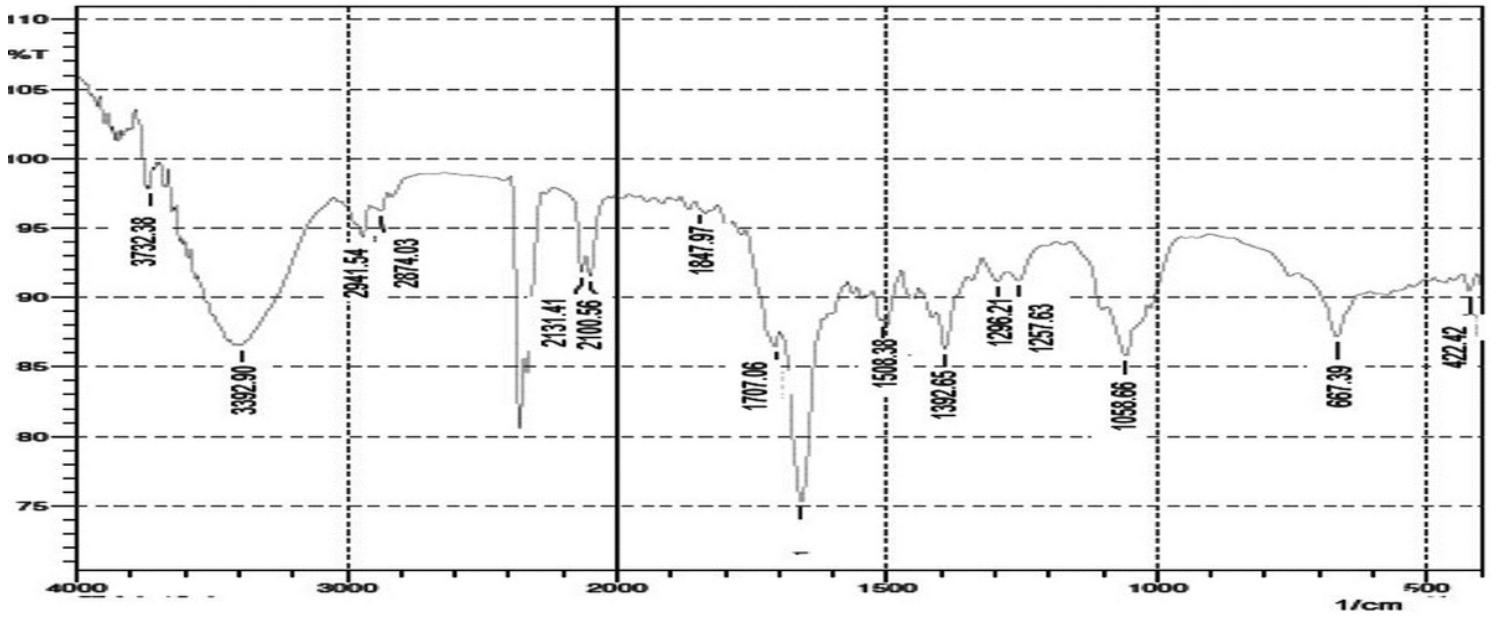


Figure 1

IR spectral study of Aegle marmelos showing the presence of functional groups of phytoconstituents such as marmelosin, marmelid, and psoralen.

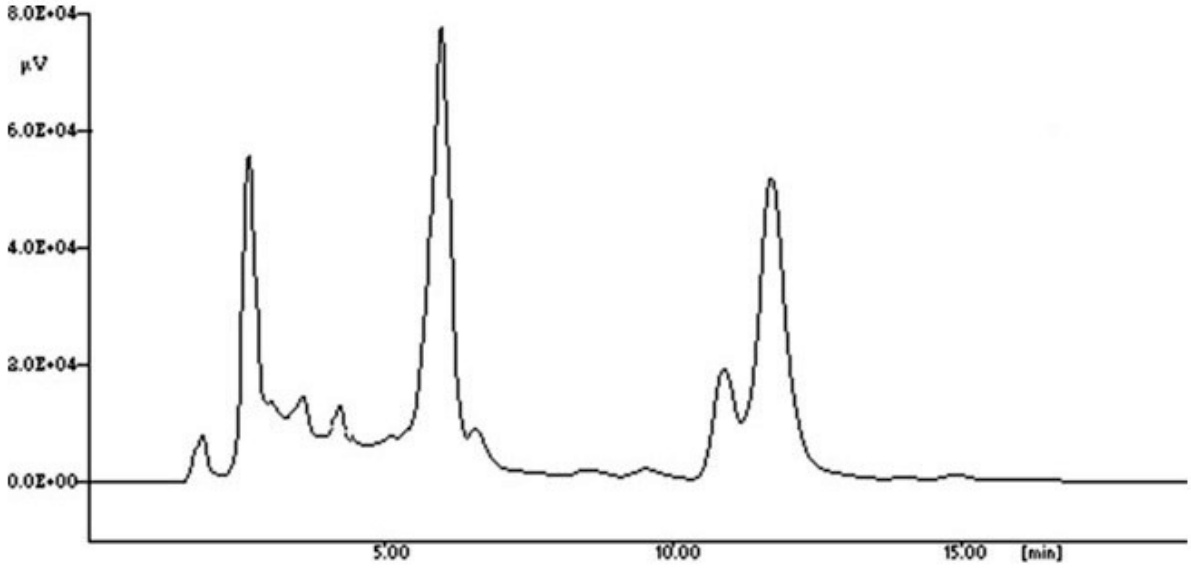


Figure 2

HPLC chromatogram of the methanolic extract of Aegle marmelos confirming the presence of umbelliferone, scopoletin, and marmelosin.

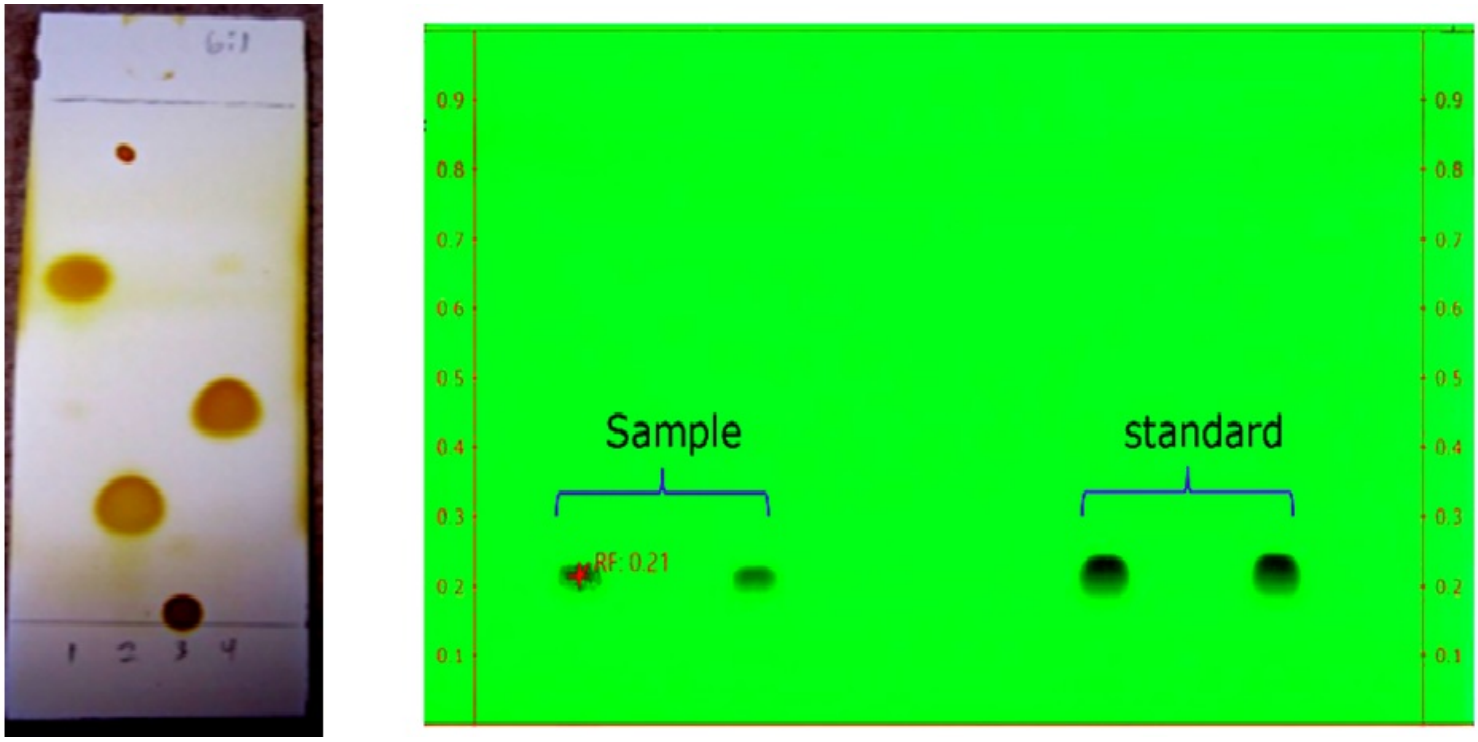


Figure 3

TLC of Aegle marmelos sample indicating the presence of test sample components with Rf values at 0.21 and 0.22 when compared with the standard samples.